8. REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) for OU 3-13 were developed in accordance with the NCP and CERCLA RI/FS guidance. RAOs specify contaminants and media of concern, potential exposure pathways, and remediation goals. Remediation goals establish acceptable exposure levels that are protective of human health and the environment. Factors that are considered in establishing remediation goals are outlined in 40 CFR 300.430(e)(2)(i). RAOs are specific risk criteria that take into consideration the assumed future land uses at the INTEC. The RAOs were defined through discussions between the Agencies (IDHW, EPA, and DOE). The RAOs are primarily based on the results of the baseline risk assessment and applicable or relevant and appropriate requirements (ARARs).

To achieve a reasonable degree of protection at the WAG 3 sites, the Agencies have selected remedy for each group of sites that meet the RAOs. These remedies protect human health and the environment and meet regulatory requirements. The WAG 3 RAOs were developed for specific media (i.e., soils, perched water, or groundwater). The applicable RAOs for a particular site or group of sites depend on the specific media impacted.

RAOs were also developed for ecological receptors, based on a screening-level ERA. For release sites that pose a potential threat to both human health and ecological receptors, it is assumed that remedies selected to protect human health will be designed to address ecological concerns. A specific RAO was developed for sites that solely pose a threat to ecological receptors. For ecological receptors, the remediation goal for protection of the environment at INTEC is to reduce contaminant concentrations to less than 10 times the background COC concentration.

The INTEC land use assumptions used to develop the RAOs include industrial use prior to 2095, and potential residential use after that time. Other assumptions used to develop the RAOs included:

1. The INTEC facility will be used as an industrial facility up to the year 2095. During the period of DOE operations, expected to last to at least 2045, this area is a radiological control area.

2. Only the contaminated groundwater present in the SRPA outside of the current INTEC security fence is addressed in this ROD. The selected remedy is expected to fully address this contamination. However, this action does not address groundwater inside the current INTEC security fence, which will be addressed under OU 3-14.

3. For the time period 2095 and beyond, it is assumed that the SRPA located outside the current INTEC security fence will be used as a drinking water supply.

4. The annual carcinogenic risk at INTEC from natural background radiation due to surface elevation and background soil radiological contamination is 10^{-4} (EPA 1994, NEA 1997, UNEP 1985).

5. Permanent land use restrictions will be placed on those release site source areas and the ICDF complex, which will be closed in place, for as long as land use and access restrictions are required to be protective of human health and the environment.

The human health RAOs developed for soils and groundwater at OU 3-13 include:

1. Groundwater

   a. For INTEC-impacted groundwater (located in the groundwater contaminant plume outside of the current INTEC security fence) restore the aquifer for use by 2095 and beyond, so that the risk will not exceed a cumulative carcinogenic risk of 1×10^{-4} for groundwater ingestion.

   b. For INTEC-impacted groundwater (located in the groundwater contaminant plume outside of the current INTEC security fence) restore the aquifer to drinking water quality (below MCLs) for use by 2095 and beyond.

   c. For INTEC-impacted groundwater (located in the groundwater contaminant plume outside of the current INTEC security fence) restore the aquifer to so that the non-carcinogenic risk will not exceed a total HI of 1 for groundwater ingestion.

   d. For INTEC-impacted groundwater (located in the groundwater contaminant plume outside of the current INTEC security fence), prevent groundwater consumption by the public until Objectives a, b, and c, listed above, are met.

   e. Maintain caps placed over contaminated soil or debris areas that are contained in place and the closed ICDF-complex, to prevent the release of leachate to underlying groundwater which would result in exceeding a cumulative carcinogenic risk of 1×10^{-4}, a total HI of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs) in the SRPA.

2. Surface Soils

   a. Prevent exposure to contaminated surface soils at each release site such that for all surface exposure pathways, a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1 is not exceeded at each release site. These RAOs also address "No Further Action" Sites where the current radiological contaminant levels will meet residential risk-based concentration on or before year 2095. The RAOs will be achieved as follows:

      (1) DOE Operational Phase, expected until year 2045:

         (a) Implement Institutional Controls to limit access and exposure duration at each source area to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1.

         (b) Remove contaminated soil at each source area, sufficient to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1 to a future residential user; or cap in place contaminated soil or debris areas presenting a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1.

      (2) Government Control Phase: expected between year 2045 and 2095

         (a) Implement Institutional Controls to limit the duration and frequency of exposure to non-capped contaminated soil areas by the public to

achieve a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1.

(b) Maintain caps for contaminated soil areas which are contained in place, to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1.

(c) Maintain the closed and capped ICDF complex to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1.

(3) Post-Government Control, Beyond 2095. Continue Institutional Controls at all capped areas to prevent disturbance of capped areas to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total HI of 1.

3. Perched Water

a. Prevent migration of radionuclides from perched water in concentrations that would cause SRPA groundwater outside the current INTEC security fence to exceed a cumulative carcinogenic risk of 1×10^{-4}, a total HI of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs) in 2095 and beyond.

b. Prevent excavations into and drilling through the contaminated earth materials remaining after the desaturation of the perched water to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4}, a total HI of 1; and protection of the SRPA to meet Objective 3a listed above.

4. Snake River Plain Aquifer (INTEC-derived groundwater contaminant plume outside current INTEC security fence)

a. Prior to 2095, prevent current on-site workers and general public from ingesting SRPA groundwater that exceeds a cumulative carcinogenic risk of 1×10^{-4}; a total HI of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs).

b. In 2095 and beyond, ensure that SRPA groundwater does not exceed a cumulative carcinogenic risk of 1×10^{-4}; a total HI of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs).

5. Other Areas

a. For other source areas that either pose a safety hazard, a threat of release to groundwater, or an ecological hazard, the RAOs include:

(1) Eliminate the safety hazard posed by buried compressed gas cylinders at sites CPP-84 and CPP-94.

(2) Eliminate the threat of release to the SRPA posed by the SFE-20 Hot Waste Tank System.

(3) Prevent ecological receptor exposure to surface soil COCs with a concentration greater than 10 times background concentrations that may cause adverse effects to resident populations of flora or fauna, as determined by the screening level ERA.

8.1 Remediation Goals

To meet the RAOs, remediation goals are established. These goals generally are quantitative cleanup levels based primarily on risk to human health and the environment. The remediation goals are based on the results of the BRA and evaluation of expected exposures and risks for selected alternatives. If an ARAR is more restrictive, then the ARAR standard is used as the remediation goal. The remediation goals will be used to assess the effectiveness of the selected remedial alternatives in meeting the RAOs.

A 1×10^{-4} cumulative carcinogenic risk or cumulative HI of 1 for noncarcinogenic contaminants, whichever is more restrictive for a given contaminant, is the primary basis for determining remediation goals for the OU 3-13 sites of concern. The higher end of the carcinogenic risk range has been selected because the carcinogenic risk at INTEC from natural background radiation due to surface elevation and background soil radiological contamination is estimated at 10^{-4} (EPA 1994, NEA 1997, UNEP 1985).

Remediation goals for contaminated soils are based on soil concentrations that satisfy the 1×10^{-4} carcinogenic risk goal or non-carcinogenic HI of 1 for current non-workers and future workers and residents. Risk-based soil concentrations corresponding to a 1×10^{-4} risk or a HI of 1 for individual soil COCs are presented in Table 8-1. If more than one COC is present at a particular release site, these activities or concentrations will be modified so that the cumulative risk is 1×10^{-4} or HI is 1. These risk-based remediation goals will be used to verify the effectiveness of the selected remedial action and to determine if additional remedial action (such as additional excavation) is necessary prior to closing the release site.

Table 8-1. Soil risk-based remediation goals.

Contaminant of Concern	Soil Risk-Based Remediation Goal[a] For Single COCs[b] (pCi/g or mg/kg)
Radionuclides	
Am-241	290
Cs-137	23
Eu-152	270
Eu-154	5200
Pu-238	670
Pu-239/240	250
Pu-241	56,000
Sr-90	223
Nonradionuclides[c]	
Mercury (human health)	23

a. Source of risk-based soil remediation goals: Table 2-1 of the OU 3-13 FS. Risk-based remediation goals developed for residential scenario.

b. If multiple contaminants are present, use a *sum of the fractions* to determine the combined COC remediation goal.

c. The mercury remediation goal was selected from the EPA Region 3, April 1996, screening guidance for soil ingestion under the residential scenario.

Dose-based soil remediation goals that correspond to the concentration- or activity-based soil remediation goals in Table 8-1 will be developed during RD to facilitate field implementation of the remedial action. It should be noted that for current on-site DOE-workers, the occupational dose limit is specified in 10 CFR 835.202. The annual occupational dose limit is a total effective dose equivalent equal to 5 rem (0.05 Sv). For exposure of the general public prior to the Year 2095, land use is projected as industrial. The above remediation goals combined with institutional controls are considered protective for industrial use of the area by the general public prior to the Year 2095.

Nonradionuclide remediation goals for mercury, lead, and chromium were also estimated for ecological receptors. The ecological receptor remediation goals estimated for these constituents are 0.5 mg/kg for mercury, 170 mg/kg for lead, and 330 mg/kg for chromium. These remediation goals are being used because of the small volume of the sites and the cost effectiveness of taking remedial action versus additional study to refine the estimate. An evaluation of whether additional soil excavation is necessary to protect ecological receptors will be conducted after the WAG 10 plant uptake treatability study is completed.

Remediation goals for INTEC-derived COCs present in the SRPA groundwater outside the current INTEC security fence are based on the applicable State of Idaho groundwater quality standards (IDAPA 16.01.011.200). The SRPA COCs consist of tritium, Sr-90 and daughters, I-129, Np-237, chromium, and mercury prior to 2095 and Sr-90, I-129, Np-237, plutonium and uranium isotopes and their daughters, and mercury in 2095 and beyond. The SRPA groundwater remediation goals for these COCs are presented in Table 8-2.

The remediation goal for INTEC-derived alpha-emitting radionuclides (i.e., Np-237, Pu isotopes and their daughters, Am-241, and U isotopes and their daughters) in SRPA groundwater outside the current INTEC security fence corresponds to a cumulative alpha-activity of 15 pCi/L in the year 2095 and beyond. Modeling has shown that alpha-emitting radionuclides are not expected to exceed the 15 pCi/L standard in the SRPA inside the current INTEC security fence until the year 2750, with a peak concentration occurring in the year 3804. Remediation, if necessary, of the Tank Farm inside the current INTEC security fence are expected to mitigate the future alpha-emitting radionuclide impacts in the SRPA outside the current INTEC security fence. Remediation goals for the alpha-emitting radionuclides in the SRPA inside the current INTEC security fence will be established in the final action developed in OU 3-14.

The remediation goal for beta-gamma-emitting radionuclides (tritium, Sr-90 and daughters, and I-129) in SRPA groundwater outside the current INTEC security fence is restricted to a cumulative dose of 4 mrem/yr in the year 2095 and beyond. The remediation goals for chromium and mercury are 100 ug/L and 2 ug/L, respectively, for individual constituent MCLs.

8.1.1 Tank Farm Soils Interim Action (Group 1)

The principal threats at the Tank Farm Soils release sites are external exposure to radiation and potential leaching and transport of contaminants to the perched water or the SRPA. The remediation goals for the Tank Farm Soils interim action are:

1. Preventing intrusion into soil contaminants by the general public

2. Reduce precipitation infiltration by approximately 80% of the average annual precipitation at the site

3. Maximize run-off and minimize surface water ponding on the Tank Farm

4. Prevent surface water run-on from a 1 in 25 year, 24 hour storm event

5. Minimize infiltration and subsequent contaminant leaching due to external building drainage and run-on.

These remediation goals support groundwater RAOs 1a through 1d; surface soil RAO 2A(1)(a), perched water RAO 3a, and SRPA RAO 4b.

8.1.2 Soils Under Buildings and Structures (Group 2)

The primary threat posed by Soils Under Buildings and Structures sites is external exposure to radionuclides and possible leaching and transport of soil contaminants to the perched water or SRPA. The selected alternative for Group 2 is a deferred action. It is assumed that the present buildings or structures aid in limiting external exposure and infiltration directly over the contaminated soils.

Remediation goals were developed for the Soils Under Buildings and Structures for the pre-D&D and post-D&D time periods. The remediation goals for the pre-D&D time period are to prevent exposure to current workers and non-workers and to minimize possible leaching and transport of contaminants to underlying SRPA groundwater. The remediation goals for the post-D&D time period are to prevent exposure to future workers and residents and to minimize possible leaching and transport of contaminants to underlying SRPA groundwater.

Table 8-2. SRPA remediation goals.

Contaminant of Concern	SRPA Remediation Goals (Maximum Contaminant Levels) For Single COCs[a]	Decay Type
Beta-gamma emitting radionuclides	Total of beta-gamma emitting radionuclides shall not exceed 4 mrem/yr effective dose equivalent	Beta-Gamma
Sr-90 and daughters	8 pCi/L	Beta
Tritium	20,000 pCi/L	Beta
I-129	1 pCi/L[b]	Beta-Gamma
Alpha-emitting radionuclides	15 pCi/L total alpha emitting radionuclides	Alpha
Uranium and daughters	15 pCi/L	Alpha
Np-237 and daughters	15 pCi/L	Alpha
Plutonium and daughters	15 pCi/L	Alpha
Am-241and daughters	15 pCi/L	Alpha
Nonradionuclides		
Chromium	100 µg/L	Not applicable
Mercury	2 µg/L	Not applicable

a. If multiple contaminants are present, use a sum of the fractions to determine the combined COCs remediation goals.

b. Derived concentration if only beta-gamma radionuclide present.

These remediation goals will be accomplished by the following:

1. Pre-D&D

   a. Warning current building or structure users that contaminated soils lie beneath the basement floor. Maintaining the buildings or structures to minimize moisture infiltration and to prevent unacceptable exposure to current industrial users.

   b. Minimizing surface water run-on and precipitation infiltration adjacent to the buildings or structures by modifying drainage patterns around buildings and performing surface modifications as necessary to minimize leaching and transport of soil contaminants to underlying SRPA groundwater.

2. Post-D&D

   a. *Implementing the institutional controls described in Table 11-1.*

   b. Capping the contaminated areas with an engineered barrier in accordance with the substantive requirements of the hazardous waste landfill closure standards (IDAPA 16.01.05.008 [40 CFR 264.310]).

   c. *Excavating the contaminated soils that exceed the soil remediation goals listed in* Table 8-1 and subsequent disposal and management in the ICDF.

These remediation goals support groundwater RAOs 1a through 1e, surface soil RAO 2a, perched water RAO 3a, and SRPA RAO 4b.

8.1.3 Other Surface Soils (Group 3)

The primary threat posed by the Other Surface Soils is external exposure to contaminated soils. The remediation goal for the Other Surface Soils is to prevent external exposure to current workers and non-workers and future workers and residents. This remediation goal will be accomplished by:

1. Implementing the institutional controls described in Table 11-1.

2. Minimizing future residental exposure to surface soils in 2095 and beyond by excavating the contaminated soils exceeding the remediation goals in Table 8-1, to a minimum depth of 3m (10 ft) and subsequent disposal and management of the excavated soils in the ICDF.

3. Capping the contaminated areas that are not excavated with an engineered barrier in accordance with the substantive requirements of the hazardous waste landfill closure standards (IDAPA 16.01.05.008 [40 CFR 264.310]).

The remediation goal supports surface soil RAO 2a.

8.1.3.1 INEEL CERCLA Disposal Facility (ICDF) Goals and Requirements. Contaminated soils from the Group 3 sites will be disposed and managed in the ICDF. The primary threats posed by soils and debris disposed and managed in the ICDF are external exposure to radiation and the release of leachate to underlying groundwater that could potentially impact the SRPA. The remediation goal for the ICDF is to consolidate contaminated soils at a single location to prevent exposure of human and

ecological receptors. This remediation goal will be accomplished by siting, designing, operating, and closing the ICDF to prevent exposures or leachate releases to the underlying SRPA groundwater. The siting, design, operation, closure, and post-closure requirements necessary to accomplish these remediation goals include:

Siting Requirements—The ICDF will meet or exceed RCRA Subtitle C location standards specified in IDAPA 16.01.05.008 (40 CFR 264.18).

Design Requirements—The ICDF design will:

1. Meet or exceed RCRA Subtitle C design standards specified in IDAPA 16.01.05.008 (40 CFR 264.301 and 40 CFR 264.302) and the PCB Chemical Waste Landfill design requirements 40 CFR 761.75.

2. Minimize precipitation run-on and maximize precipitation run-off to effectively reduce infiltration through the contaminated soils and debris.

3. Minimize subsidence of the waste and the landfill cap.

4. Ensure that the resulting design is protective of human and ecological receptors.

5. Ensure that the resulting design is protective of the SRPA.

Operational Requirements—The ICDF operation will:

1. Limit disposed wastes to those generated by the INEEL CERCLA program.

2. Limit disposed wastes to those with contaminant concentrations that will not result in MCLs being exceeded in the SRPA.

3. Limit disposed wastes to low level radioactive waste, PCB solids, hazardous, and mixed low level radioactive waste.

4. Treat waste (soils, debris, and treatment residues) on-Site as necessary to meet Agency-approved Waste Acceptance Criteria developed during the RD.

5. Treat waste (soils, debris, and treatment residues) originating from outside the WAG 3 AOC to comply with the land disposal requirements specified in IDAPA 16.01.05.011 (40 CFR 268 and 40 CFR 268.49) as applicable.

6. Minimize leachate generation. Leachate will be collected and treated using physical/chemical treatment (i.e., evaporation in a surface impoundment designed in accordance with the substantive requirements of the hazardous waste surface impoundments (IDAPA 16.01.05.008 [40 CFR 264.221]). Residues from the evaporation process will be managed in the ICDF as necessary during the active life and post-closure period of the ICDF cells.

Closure and Post-Closure Requirements—The ICDF closure and post-closure will:

1. Meet or exceed RCRA Subtitle C closure and post-closure care requirements specified in IDAPA 16.01.05.008 (40 CFR 264.310).

2. Ensure that the final cover is designed to serve as an intrusion barrier for a period of at least 1,000 years.

3. Minimize subsidence of the landfill and its final cover.

4. Place easily located permanent markers at all corner boundaries for each cell of the landfill that identify the potential exposure hazards.

5. Place permanent land use restrictions, zoning restrictions, and deed restrictions on the ICDF and its adjacent buffer zone to permanently preclude industrial or residential development until unacceptable risk no longer remains at the site.

6. Include the disposal records and the surveyed permanent marker locations in the land use restriction documents.

These remediation goals support groundwater RAOs 1a through 1e, surface soil RAOs 2a(1)(a) and 2a(2)(c), and SRPA RAO 4b.

8.1.4 Perched Water (Group 4)

The primary threat posed by perched water is migration of contaminants to the SRPA. The perched water remediation goals are to:

1. Reduce recharge to the perched zones

2. Minimize migration of contaminants to the SRPA, so that SRPA groundwater outside of the current INTEC security fence meets the applicable State of Idaho groundwater standards by 2095.

The remediation goals for the perched water are primarily designed to reduce the moisture content of the perched zone so that the contaminant transport rate in the vadose zone is reduced and radionuclide contaminants present in the perched zone have more time to naturally decay and reduce the concentration of potential contaminants released to the SRPA.

The perched water remediation goals will be accomplished by:

1. Limiting recharge to the perched zone by closing and relocating the existing percolation ponds, and ceasing lawn irrigation, where necessary, at the INTEC so that the moisture content is sufficiently reduced to retard Sr-90 migration by approximately three (3) half-lives (about 90 years).

If the moisture content and contaminant flux is not sufficiently reduced as indicated by moisture content and perched water monitoring and verified by the OU 3-13 vadose zone model, then additional infiltration controls will be implemented to achieve the necessary desaturation, and corresponding

reduction in contaminant transport rate, in the perched zone. The additional infiltration controls that will be implemented (in the listed order) include:

1. Lining the Big Lost River

2. Closing and relocating the existing Sewage Treatment Plant lagoons and infiltration galleries

3. Upgrading the INTEC-wide drainage controls, repairing leaking fire water lines, and eliminating steam condensate discharges.

These remediation goals support groundwater RAOs 1a through 1c, perched water RAOs 3a and 3b, and SRPA RAO 4b.

8.1.5 Snake River Plain Aquifer (Group 5)

The primary threat posed by SRPA is ingestion of contaminated groundwater. The remediation goals for the SRPA outside the current INTEC security fence are to:

1. Preventing current on-site workers and non-workers during the institutional control period from ingesting contaminated drinking water above the applicable State of Idaho groundwater standards or risk-based groundwater concentrations.

2. Achieving the applicable State of Idaho groundwater standards or risk-based groundwater concentrations in the SRPA plume south of the INTEC security fence by the year 2095.

Modeling predicts that the applicable State of Idaho groundwater standards will be naturally achieved by 2095, except for Sr-90, I-129, and plutonium isotopes. Modeling also predicts that removal of the existing percolation ponds (the principal component of the selected Perched Water remedy) will reduce the moisture content so that the individual Sr-90 MCL is achieved by 2095.

Modeling also has shown that plutonium, an alpha-emitting radionuclide, is not expected to exceed the 15 pCi/L alpha-emitting radionuclide standard in the SRPA inside of the current INTEC security fence until the year 2750, with a peak concentration occurring in the year 3804. Remediation, if necessary, of the SRPA inside the current INTEC security fence will mitigate the future plutonium impacts in the SRPA outside the current INTEC security fence. The remedy for the SRPA inside the current INTEC security fence is being developed under OU 3-14. Therefore, a decision on plutonium remediation goals is deferred to the OU 3-14 ROD.

The SRPA remediation goals will be accomplished by:

1. Maintaining institutional controls over the area of the INTEC-derived SRPA contaminant plume outside of the current INTEC security fence to prevent exposure to contaminated groundwater during the time that groundwater in the aquifer remains above the remediation goals specified in Table 8-2.

2. Determining if groundwater quality outside the current INTEC security fence will be restored by 2095 and beyond. If the modeled action levels for COCs are exceeded, a contingent pumping and treatment action will be implemented to remove sufficient contaminant source to facilitate aquifer restoration by 2095.

These remediation goals support groundwater RAOs 1a through 1e, and SRPA RAOs 4a and 4b.

8.1.6 Buried Gas Cylinders (Group 6)

The principal threat posed by the buried gas cylinders is a safety hazard, including chemical exposure, fire, explosion, and projectile hazards. The remediation goal for the buried gas cylinders is to remedy the safety hazard posed by the disposed cylinders.

The remediation goal will be accomplished by:

1. Excavating, removing, treating, and disposing the cylinders (waste that meets the ICDF WAC will be disposed in the ICDF).

The Agencies may elect to pursue a contingent remedy of capping in place pursuant to the substantive requirements of IDAPA 16.01.05.008 (40 CFR 264.310) if safety concerns with excavation and removal prevent implementation of the selected remedy.

The remediation goal supports Other Areas RAO 5a.

8.1.7 SFE—20 Hot Waste Tank System (Group 7)

The principal threats posed by the SFE-20 Tank system is external exposure and the potential for a contaminant release to the environment. The remediation goals for the SFE-20 tank system are as follows:

1. Limit potential external exposures to workers and non-workers

2. Remove radioactive and hazardous substances remaining in the tank system to prevent potential contaminant releases to the underlying soils or groundwater.

The remediation goals will be accomplished by:

1. Maintaining existing institutional controls to prevent current worker and non-worker exposure.

2. Removing, excavating, treating, and disposing the SFE-20 hot waste tank system waste and components to eliminate the threat of release to the environment (waste that meets the ICDF WAC will be disposed in the ICDF).

3. Remediating contaminated soils present beneath the SFE-20 tank system that may pose an external exposure risk or threat to groundwater (waste that meets the ICDF WAC will be disposed in the ICDF).

These remediation goals support Other Areas RAO 5a and also support groundwater RAOs 1a through 1c.

9 DESCRIPTION OF ALTERNATIVES

A range of cleanup alternatives was developed and evaluated against the nine CERCLA evaluation criteria for each of the seven release site groups. The alternatives were developed from a list of representative remediation technologies for technical and cost evaluation purposes. With the exception of the "No Action" alternative, the selected remedies are protective of ecological concerns. The "No Action" alternative is not protective of human health and the environment beyond the institutional control period. The alternatives evaluated for each group are summarized in the following sections. For more detailed descriptions of the evaluated alternatives refer to the OU 3-13 FS and FSS (DOE-ID 1997a, DOE-ID 1998a). More detailed descriptions of the selected alternatives are found in Section 11. It should be noted that during preparation of the cost estimates for the FS, assumptions were made regarding what activities comprise existing institutional controls (e.g., land use/site access restrictions, monitoring, maintenance). The following alternative descriptions reflect those assumed activities. The original broad assumptions have changed, however, and the current, more specific institutional control scenarios are presented in Section 11.

The alternative descriptions in this section and Section 10 are from the comparisons in the OU 3-13 FS. The selected alternatives have been refined subsequent to the FS. The detailed descriptions in Section 11 reflect these changes.

9.1 Tank Farm Soils Interim Action (Group 1)

After review of the OU 3-13 RI/FS, the Agencies determined that additional information was required to select a final remedy for this group of sites. The Agencies have postponed a final decision on the Tank Farm because of the uncertainty concerning contaminant extent, and site risks. Additional site characterization and risk analysis will be performed at the Tank Farm in a separate RI/FS that is designated as OU 3-14. Remedial alternatives will be developed in the OU 3-14 RI/FS using the existing and newly developed data and will be presented to the public in a separate proposed plan.

An interim action is selected for the Tank Farm in this ROD while the new RI/FS is conducted. The interim action will be performed to minimize contaminant exposures and to limit further impacts to soil and groundwater until a final remedy is implemented. A final remedy decision is anticipated prior to 2008. The interim action is consistent with the expected final remedy. Interim action alternatives were developed and evaluated for the Tank Farm in the FS Supplement. The implemented interim action will be designed to prevent exposure to contaminants present at the site and to minimize moisture that may infiltrate through the Tank Farm soils and leach and transport contaminants to the perched water, and possibly to the SRPA. Interim actions are justified because the facility will be in operation until 2012. Until the facility is closed, surface water controls remain necessary. This action will likely be a component of the final remedy. Three alternatives were developed and evaluated for the Tank Farm Soils Interim Action to meet the current remediation objectives and are discussed in the following sections.

9.1.1 Interim Alternatives Descriptions.

9.1.1.1 Alternative 1—"No Action" with Monitoring. Alternative 1 consists of the existing institutional controls currently implemented at the site. No active remediation will be performed at the site to alter the existing conditions. The existing institutional controls include site access restrictions, radiation monitoring, and maintenance for a period of 8 years or until a final remedy decision is made by the Agencies and implemented.

9.1.1.2 Alternative 2—Enhanced Institutional Controls. Alternative 2 consists of the existing institutional controls described for Alternative 1 and additional monitoring and institutional controls. This additional monitoring and controls include the installation of new clustered monitoring wells in the perched water and aquifer to enhance the existing groundwater monitoring capabilities during the interim action period and to verify hydraulic parameters and water quality. They also include additional warning signs, surface and subsurface markers, and land use restrictions to prevent exposures to contaminated groundwater.

9.1.1.3 Alternative 3—Enhanced Institutional Controls with Surface Water Control. Alternative 3 includes the existing and additional institutional controls described for Alternative 2 and an interim remedy to control surface water runon and infiltration at the Tank Farm. The interim remedy includes surface grading and sealing of the Tank Farm soils to divert 80% of the average annual precipitation away from the contaminated areas, and exterior building drainage improvements to direct water away from the contaminated areas so that moisture infiltration is minimized and contaminants are not mobilized. The run-on water will be managed as part of the existing surface water drainage system, and the run-off water will be collected and managed in a lined evaporation pond, to be constructed as part of this alternative.

9.2 Soils Under Buildings or Structures (Group 2)

Contaminant source releases are not well defined for the Soils Under Buildings and Structures sites. Contaminated soil release sites are assumed to be present as a result of accidental past releases during plant operations. The releases occurred under buildings or structures making characterization difficult. The primary threat posed by these sites is external exposure to radionuclide-contaminated soil if the buildings or structures are removed. The soils also pose a minor threat to groundwater. Although these potential releases to the environment are recognized, the release sites are not readily accessible and may remain covered by the facilities, since the buildings or structures may be closed in place as operations cease. The D&D program is determining the fate of individual buildings. Buildings may remain in place upon closure. Evaluations, conducted as part of the CERCLA 5-year review process, will confirm whether the presence of the existing structures over these sites limits soil exposures and moisture infiltration. Three alternatives were evaluated for the Soils Under Buildings or Structures group to minimize the threat of contaminant exposure or mobilization.

9.2.1 Alternatives Descriptions

9.2.1.1 Alternative 1—"No Action" with Monitoring. Alternative 1 is comprised of existing institutional controls currently implemented at the site. No active remediation will be performed under this alternative to alter the existing site conditions. The existing institutional controls include DOE land use and site access restrictions. These controls will remain in place until 2095.

9.2.1.2 Alternative 2—Containment. Alternative 2 is a deferred action which includes the existing institutional controls described for Alternative 1, additional institutional controls, and soil containment with engineered barriers. The additional institutional controls may include land or regulatory restrictions to prevent inadvertent exposure to contaminants. The proposed engineered barriers will be comprised of natural earthen materials designed to isolate the contaminants until they are no longer a risk. The final cover designs will meet ARARs and are subject to the FFA/CO review process. It should be noted that the engineered barriers cannot be constructed until adjacent building or structures have undergone D&D. In the meantime, the presence of the existing buildings or structures is assumed to limit soil exposures and moisture infiltration. The effectiveness of the buildings and structures in limiting exposures and infiltration will be evaluated as part of the CERCLA 5-year review process for OU 3-13.

If the building or structure is entombed in place, the end-state will be subject to review under the FFA/CO to ensure that the RAOs for perched water, surface soils, and the SRPA are met.

9.2.1.3 Alternative 3—Removal and Onsite Disposal. Alternative 3 was developed in the event that contaminated soils present beneath the buildings or structures become exposed following D&D. Alternative 3 includes the existing and additional institutional controls described for Alternative 2, and removal and on-Site disposal of contaminated soils exposed during D&D. The exposed contaminated soils will be excavated and disposed in the ICDF.

9.3 Other Surface Soils (Group 3)

The Other Surface Soils release sites resulted from miscellaneous contaminant spills or past waste disposal activities at the INTEC. The primary threat posed by most of these release sites is external exposure. One site (CPP-93) contains mercury at concentrations potentially hazardous to humans. Three of the sites, CPP-14, -44, and -55, pose solely an ecological risk because of nonradionuclide contaminants, such as mercury, chromium, and lead. These sites are being remediated under the screening action levels because of their small size (i.e., soil volume) and the cost benefit of not pursuing further studies on them. Five alternatives were evaluated for the Other Surface Soils release sites to address a range of potential cleanup actions that are protective of human health and the environment. The alternatives include existing and additional institutional controls, containment using an engineered barrier, removal and onsite disposal, and removal, ex situ treatment, and off-Site disposal.

9.3.1 Alternatives Descriptions

9.3.1.1 Alternative 1—"No Action" with Monitoring. Alternative 1 is comprised of existing institutional controls currently implemented at the site. No active remediation will be performed under this alternative to alter the existing site conditions. The existing institutional controls include site access restrictions, radiation surveys, air monitoring, and maintenance. These controls will remain in place until 2095.

9.3.1.2 Alternative 2—Institutional Controls. Alternative 2 includes the existing institutional controls described for Alternative 1 and additional institutional controls to control exposures to contaminated soils. The additional institutional controls include land use and/or regulatory restrictions to prevent inadvertent exposure to contaminants. For the boxed soils comprising Site CPP-92, the soils will be loaded into SEALAND®-type containers 10 years after ROD signature to provide additional stability and control.

9.3.1.3 Alternative 3—Containment. Alternative 3 includes existing and additional institutional controls described for Alternative 2 and containment using an engineered barrier. The proposed engineered barrier is comprised of natural earth materials and designed to isolate the contaminants, minimize water infiltration, and reduce contaminant leaching and transport for up to 1,000 years. The engineered barrier will be subject to operation and maintenance activities and 5-year reviews under CERCLA as long as an unacceptable risk remains. Some of the operating facilities may interfere with barrier construction, so that final containment may not be implemented until facility D&D has concluded several decades in the future.

9.3.1.4 Alternative 4A—Removal and Onsite Disposal. Alternative 4A includes the existing institutional controls described in Alternative 1 and removal and onsite disposal of low level radioactive, hazardous, mixed low level radioactive waste, or PCB contaminated soils at each release site in this group. These excavated soils will be disposed in an ICDF. After removal of soils at individual sites,

institutional controls will be terminated at each site but maintained at the location of the ICDF. The ICDF is planned to be constructed southwest of the INTEC facility and west of the current INTEC percolation ponds.

ICDF—To implement onsite disposal of WAG 3 and other CERCLA-generated wastes at the INEEL, construction and operation of an engineered disposal facility is proposed. The ICDF will be an engineered facility meeting RCRA Subtitle C design and construction requirements, which are the same regulations required for commercial disposal facilities.

The ICDF will be constructed with a disposal capacity of about 400,000 m^3 (510,000 yd^3). The disposal cells, including a buffer zone, will cover approximately 219,000 m^2 (80 acres). Current projections of INEEL-wide CERCLA waste volumes total about 356,283 m^3 (466,000 yd^3). The selected location (Figure 11-3) lies beyond the area that would be inundated by the Big Lost River 100-year flood event. However, design criteria for the life for the facility's include protection from inadvertent intrusion for up to 1,000 years. Therefore, a 1000-year flood event, assuming Mackay Dam failure, will be evaluated during the remedial design.

The ICDF will accept only those wastes generated within INEEL boundaries during CERCLA actions. The OU 3-13 wastes lie within the WAG 3 AOC. Other INEEL wastes are not included within the OU 3-13 AOC. Wastes proposed for disposal at the ICDF would include low-level, mixed low-level, hazardous, and limited quantities of Toxic Substances Control Act (TSCA) wastes. Most of the waste will be contaminated soil, but wood and debris from sites CPP-98 and CPP-99 and other INEEL CERCLA sites are expected; specific waste acceptance criteria will be developed during RD. Acceptance criteria will include restrictions on contaminant concentrations based on groundwater modeling results and the goal of preventing potential future risk to the SRPA.

9.3.1.5 Alternative 4B—Removal, Treatment, and Off-Site Disposal. Alternative 4B is identical to Alternative 4A except that disposal in an off-Site facility is contemplated. Soils will be selectively excavated to reduce the soil volume, packaged, and transported by truck or rail to a permitted engineered disposal facility located off-Site. Waste will be treated off-Site at the receiving facility, if necessary, to satisfy land disposal restrictions.

9.4 Perched Water (Group 4)

Although contaminants may be present in the perched water, this water does not pose a threat to human health because it is not available for consumption. However, it does pose a risk to human health and the environment because of its potential to migrate to the SRPA, which is designated as a primary drinking water source. Three alternatives were developed and evaluated to limit exposure to contaminated perched water, and to prevent this water from contaminating the SRPA.

9.4.1 Alternatives Descriptions

9.4.1.1 Alternative 1— "No Action" with Monitoring. Alternative 1 is comprised of existing institutional controls currently implemented at the site. No active remediation will be performed under this alternative to alter the existing site conditions. The existing institutional controls include site access restrictions, radiation surveys, perched water monitoring, and wellhead maintenance. These controls will remain in place until 2095.

9.4.1.2 Alternative 2—Institutional Controls with Aquifer Recharge Control. Alternative 2 proposes existing and additional institutional controls and aquifer recharge controls to

prevent exposures to perched water and to reduce moisture content in the perched water. The existing institutional controls are the same as those described for Alternative 1. The additional institutional controls may include land or regulatory restrictions, to prevent inadvertent exposure to contaminated perched water. In addition, perched water-monitoring wells will be installed to provide additional information about the deep perched water. The proposed remedies are actions that control sources supplying water to the perched zone. The aquifer recharge controls, discussed below, are designed to reduce leaching and transport of soil contaminants to perched water, reduce the volume of water in the perched zone, and minimize contaminated perched water releases to the SRPA.

The initial aquifer recharge controls will include removal of the percolation ponds from service and discontinuing lawn irrigation at the INTEC, where necessary. A major contribution to the perched water originates from the existing percolation ponds, which contribute approximately 70% of the water recharging the perched water bodies. Removal of this water source will slow the rate of contaminant transport to the SRPA sufficiently to allow natural radioactive decay to reduce the mass of Sr-90 in the perched zone so that applicable groundwater quality standards will not be exceeded in 2095 or beyond in the SRPA. Discharge to the existing percolation ponds will cease on or before December 31, 2003. See Section 11 for a more detailed description.

If removal of the percolation ponds and ceasing lawn irrigation do not protect the aquifer, additional aquifer recharge controls will be implemented. Additional recharge controls may include lining the Big Lost River (which contributes about 21% of the perched water recharge), repairing leaking fire water lines, curtailing steam condensate discharges to the subsurface, or removing the existing Sewage Treatment Plant lagoons and infiltration galleries. The costs of implementing these additional recharge controls have not been included in the cost estimates in Section 11.

9.4.1.3 Alternative 3—Aquifer Recharge Control and Perched Water Removal, Treatment, and Disposal. Alternative 3 consists of the existing and additional institutional controls and aquifer recharge controls described for Alternative 2 with localized pumping, treatment, and disposal of perched water contaminant hotspots for a period of 25 years. Localized perched water extraction would attempt reduction of contaminant mass and contaminant flux to the SRPA. Five new extraction wells would be installed to perform perched water removal and would be included in the perched water-monitoring program. Contaminated perched water would be removed from the five new wells and nine existing wells using pulsed pumping at low pumping rates to allow for sufficient well recovery. Extracted perched water would be stored in storage tanks, and treated and disposed. Approximately 174 million L (46 million gal) of perched water would be extracted under this alternative.

9.5 Snake River Plain Aquifer Interim Action (Group 5)

Contamination in the SRPA primarily resulted from historic wastewater disposal practices at the former INTEC injection well. The COCs are radionuclides and mercury. The contaminated soils and perched water also contribute to future contamination in the SRPA. Predictive modeling suggests that if recharge source control actions are not taken, additional contamination may be leached and transported to the SRPA. In the conceptual model, the currently contaminated perched water is also a significant source of future contamination to the SRPA. Four alternatives were developed to manage the risk posed by contaminants in the SRPA.

9.5.1 Alternatives Descriptions

9.5.1.1 Alternative 1—"No Action" with Monitoring. Alternative 1 is comprised of existing institutional controls presently implemented at the site to minimize potential exposure to contaminated

groundwater. No active remediation will be performed under this alternative to alter the existing site conditions. The existing institutional controls include site access restrictions, radiation surveys, groundwater monitoring, and maintenance. These controls will remain in place until 2095. Groundwater monitoring will include sampling and analysis of existing and new groundwater wells until 2095 to determine changes in contaminant concentrations and water quality, and the rate of the contaminant plume migration. Groundwater monitoring will be conducted, as necessary, to verify achievement of the RAOs.

9.5.1.2 *Alternative 2A—Institutional Controls, Monitoring, and Source Control.*

Alternative 2A proposes the existing institutional controls described for Alternative 1, additional institutional controls, and additional monitoring and perched water infiltration source control to limit exposure to contaminated groundwater. The additional institutional controls include land use or regulatory restrictions to prevent exposure to contaminated groundwater within the INTEC. In addition, six new groundwater-monitoring wells will be installed to supplement the 10 existing wells. Under this alternative, contaminants present in the SRPA will decrease in concentration by radioactive decay and dispersion. Source control measures, included in other alternative remedies (Group 4, Alternatives 2 and 3), significantly decreases future contamination in the SRPA. Predictive modeling demonstrates that if the contaminant contributions from the perched water mobilized by the existing percolation ponds are eliminated by relocation of the percolation ponds, then contaminant concentrations in downgradient wells will still be slightly above acceptable limits at year 2095. Monitoring will be conducted to assess reduction of contaminant levels in the SRPA and to ensure that no down-gradient receptors will be impacted. Monitoring will be maintained until the contaminant concentrations are below the RAOs.

9.5.1.3 *Alternative 2B—Institutional Controls with Monitoring and Contingent Remediation.*

Alternative 2B includes the existing and additional institutional controls described for Alternative 2A plus active groundwater remediation if sufficient quantities of contaminants of concern are found above the groundwater action level(s).

This action level(s), which is based on modeling results described in Section 5.3.2.3 of the FS Supplement (DOE-ID 1998a), ensures that existing concentrations of I-129 measured in the SRPA will not result in groundwater concentrations in the year 2095 exceeding the derived MCL of 1 pCi/L. If action levels are exceeded, as described in Section 11, treatability studies will commence to determine if pumping from the zones of highest contamination is feasible and to evaluate methods to remove I-129 or other COCs from the groundwater.

The cost estimate for this alternative is based on the assumption that groundwater will be extracted from about 20 wells at an estimated rate of 3.8 L/min (1 gpm) per well. The actual number of wells and extraction rates will be determined during remedial design. Actual treatment technologies will be selected during the proposed treatability studies. For comparison and cost estimating purposes, ion exchange treatment technology is assumed to be part of this alternative. Remedial action will be terminated following the removal of the design-specified volume of groundwater.

9.5.1.4 *Alternative 3—Contingent Localized Groundwater Removal, Treatment, and Disposal.*

Alternative 3 includes the existing and additional institutional controls described for Alternative 2B, and localized removal, treatment, and disposal of groundwater extracted from SRPA hotspots until 2095, if the I-129 or other COCs action level(s) is exceeded. Groundwater will be extracted from the full vertical extent of the aquifer without targeting any specific layer. Groundwater extraction from within hotspots will locally reduce the contaminant mass in the aquifer. Five new extraction wells and six new injection wells will be installed in areas of high contaminant concentrations in the SRPA to depths of about 183 m (600 ft) bgs. Actual treatment technologies will be selected during the proposed treatability studies. For comparison and cost estimating purposes, the most likely candidate treatment

technology, ion exchange, is assumed to be part of this alternative. Extracted groundwater will be treated in a newly constructed water treatment plant using ion exchange to concentrate the contaminants. The concentrated waste will be treated and disposed onsite. The remediated water will be reinjected into the aquifer through the six injection wells. Remediation could be challenging and may require treatability studies because current technology is not sufficiently developed to remove I-129 to its derived MCL of 1 pCi/L. The treatability studies will also evaluate the presence of mercury, Sr-90, chromium, Tc-99, and tritium, all of which are known or are predicted to be present in the groundwater plume at significant concentrations. While these contaminants are not long-term risk drivers, they may foul the groundwater treatment system or pose radiological exposure concerns if brought to the surface for treatment. Groundwater extraction and injection will also reduce contaminant transport by hydraulically controlling the contaminant plume in localized areas. A total of approximately 492 billion L (130 billion gal) of water, over the 100-year operating life, would be extracted and treated under this alternative.

9.6 Buried Gas Cylinders (Group 6)

The Buried Gas Cylinders group is comprised of Sites CPP-84 and CPP-94. These sites generally contain buried compressed gas cylinders that contain construction gases at Site CPP-84 and hydrofluoric acid at Site CPP-94. The exact number of cylinders is unknown but is estimated to be between 40 and 100. The principal threat posed by either of these sites is the potential for an injury caused by puncture or explosion of the cylinders. A risk assessment was not performed for these sites during the RI/BRA. Three alternatives were developed and evaluated for the Buried Gas Cylinders to address the safety hazards posed by these sites.

9.6.1 Alternatives Descriptions

9.6.1.1 Alternative 1—"No Action" with Monitoring. Alternative 1 consists of existing institutional controls. Under Alternative 1, no active remediation will be performed at the site. The existing institutional controls will consist of security, access restrictions, and site inspections until 2095.

9.6.1.2 Alternative 2—Removal, Treatment, and Disposal. Alternative 2 consists of the removal, ex situ treatment, and disposal of the gas cylinders at each site. This alternative will also include initial site characterization using geophysical surveys to determine the location and quantity of buried gas cylinders prior to removal. After the cylinders are located, they will be removed using conventional excavation techniques within a containment structure. Gases present in the excavated cylinders will be vented to the atmosphere if they are benign, or treated using a method suitable for the particular gas. A contractor that specializes in gas cylinder removal, treatment, and disposal will perform Alternative 2. The subcontractor performing work at an appropriate offsite facility will dispose of any treatment residuals. The sites will be maintained under existing institutional controls until the cylinders are removed, treated, and disposed.

9.6.1.3 Alternative 3—Containment. Alternative 3 consists of the existing institutional controls described for Alternative 1, additional institutional controls, and containment. Additional institutional controls will include land-use or regulatory restrictions. The principal component of Alternative 3 is containment using an engineered barrier. The barrier will consist of natural earthen materials designed to isolate the buried gas cylinders. A concrete pad will be poured over each of the sites prior to placement of the engineered barrier to minimize the potential for an uncontrolled gas release during barrier construction.

9.7 SFE-20 Hot Waste Tank System (Group 7)

Based on the results of the preliminary investigation conducted at the SFE-20 site in 1984, radiological contamination is present within the tank liquids and sludges, and on the tank, tank vault, and pump pit surfaces. The principal threat posed by the SFE-20 tank system is a release of the radioactive contaminants from the tank due to loss of integrity that could potentially contaminate soils, perched water, or SRPA groundwater beneath the site. In 1976, the tank and its transfer system were replaced. The SFE-20 inlet pipe was disconnected, and the pipe leading to the SFE-20 tanks was capped. At present, there is no exposure to humans or ecological receptors under existing conditions given that the tank vault is 3 m (10 ft) below the ground surface and area access is restricted. However, radiation exposure could occur if the existing access restrictions are not maintained. In addition, the excavation needed to cap the piping to SFE-20 may have been backfilled with radionuclide contaminated soil. Four alternatives were developed and evaluated for the SFE-20 tank system to limit exposure to radiation or to minimize the potential for a release to occur from the tank system.

9.7.1 Alternatives Descriptions

9.7.1.1 Alternative 1—"No Action" with Monitoring. Alternative 1 consists of existing institutional controls. Under Alternative 1, no active remediation will be performed at the site. The existing institutional controls will consist of security, access restrictions, site inspections, environmental monitoring, and general maintenance until 2095.

9.7.1.2 Alternative 2—In Situ Stabilization with Containment. Alternative 2 consists of the existing institutional controls described for Alternative 1, additional institutional controls, in situ treatment, and containment. Characterization of tank liquid, sludge, and surrounding soil is needed for remedial design. Additional institutional controls will include land-use and regulatory restrictions. The principal component of Alternative 2 is containment using an engineered barrier. The barrier will consist of natural earthen materials designed to minimize exposure and moisture infiltration at the site for up to 1,000 years. Prior to placing the barrier, the tank system, including the tank vault, will be filled with concrete grout to stabilize tank liquids and sludge and minimize differential settlement after capping.

9.7.1.3 Alternative 3—Liquid Removal and Treatment with In Situ Stabilization. Alternative 3 consists of existing and additional institutional controls described for Alternative 2, removal and ex situ treatment of the tank liquid, and in situ treatment of the tank sludge, tank, and associated structures. Characterization of tank liquid, sludge, and surrounding soil is needed for remedial design and liquid waste disposal. The tank liquid will be removed and treated at the PEW evaporator. The tank sludge, tank, and associated structures will be filled with concrete or similar grout to solidify and stabilize the contaminants that remain.

9.7.1.4 Alternative 4—Removal, Treatment, and Disposal. Alternative 4 includes the existing institutional controls described for Alternative 1, removal and ex situ treatment of the tank liquid and sludge, and excavation, removal, and onsite disposal of the tank and associated structures. The tank liquid will be removed and treated as described in Alternative 3. The tank sludge will be removed and treated (ex situ) using a suitable grout to solidify and stabilize the contaminants in the sludge. Characterization of tank sludge, liquid, and surrounding soil is needed for remedial design and waste disposal. The sludge will be drummed and disposed at a suitable engineered disposal facility. The remaining components of the tank system will be excavated, removed, and disposed either in the ICDF or offsite depending on the ICDF waste acceptance criteria. The excavation will be backfilled to grade with clean soils.